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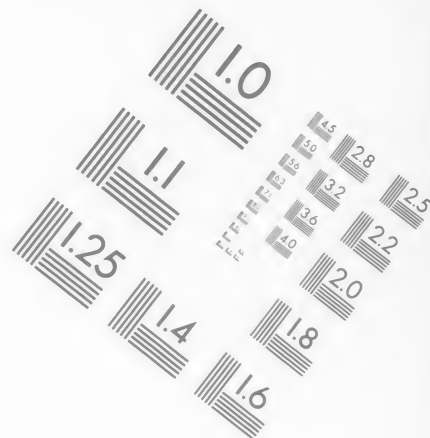
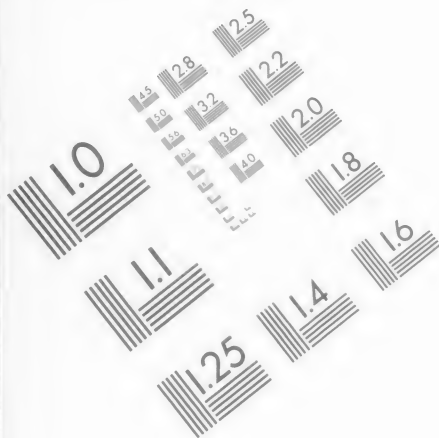
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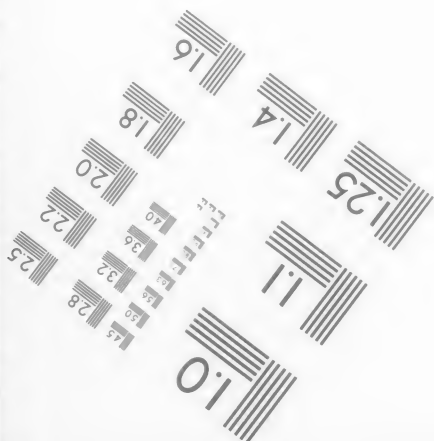
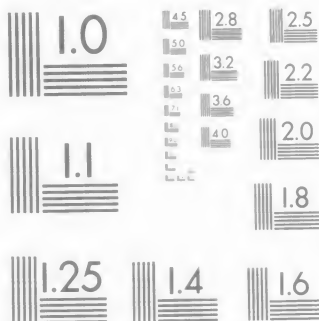
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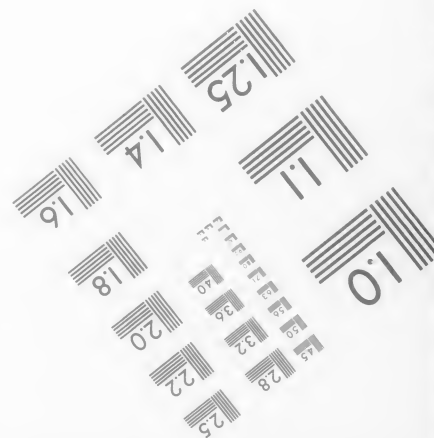
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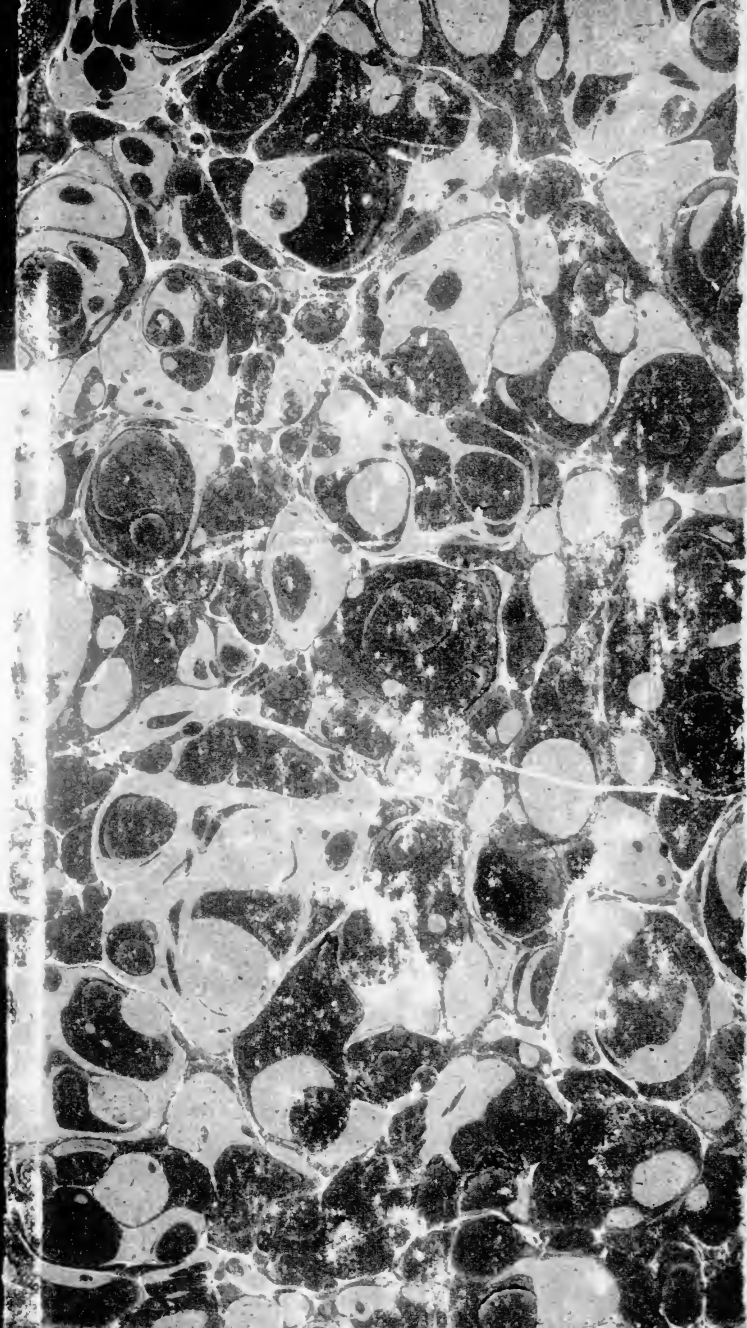


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The new cosmology



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Library

THE NEW COSMOLOGY

BY

CHARLES PORTER SNYDER

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E. R. S. 11 June 07

PREFACE.

IN July, 1894, the writer culminated certain valuable (and possibly original) discoveries; and during the said month he sent several brief articles to different scientific periodicals for publication.

Not being successful in having the theory thus published, he concluded to extend his investigations so long as he might be financially enabled, and then embody the principal results in a brief treatise.

The following is a list of the parties to whom the writer has mailed expositions of his cosmological theory at the dates specified:

In July, 1894: *Scientific American*, *Popular Science Monthly*, *Popular Science News*, *American Journal of Science*; London, *Edinburgh and Dublin Philosophical Magazine*; Smithsonian Institute "for their Contributions to Knowledge;" *Knowledge*, of London; T. A. Edison; J. H. Van Amringe, of Columbia College.

In September, 1894: American Association for Advancement of Science.

In February or March, 1895: Ira Remsen, of Hopkins University.

In March, 1895: J. D. Dana, J. H. Van Amringe.

The last three expositions sent were accompanied with hektograph charts and tables: illustrating symmetrical atomic arrangements, and types of interlocking atomic networks; also, theoretical ratios of atomic size, and specific gravities of different atomic networks.

The writer has not been able to secure the financial assistance

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which would be necessary for lithographing and publishing the hektograph charts and tables referred to; but he hopes that this brief exposition of his cosmological theory will be deemed worthy of recognition by such scientists as are conversant with the subject.

C. P. SNYDER.

NOTE.—The writer has secured the following book titles at the Librarian's office, Washington, D. C.

February 16, 1895. "The New Cosmology."

March 12, 1895. "Atomic Geometry: Based upon their Sphericity, Smoothness, Exact Sizes, Compact Arrangements, and Interlocking Cohesion Networks; acquired in their ages of grinding."

March, 1895. "The Universal Transmutation of Substance: Resulting from the Perfect Brittleness of its Separate Parts, and their Breakage by Collision."

April 8, 1895. "Atomic Size Ratios: Computed from those Symmetrically Compact Arrangements in which the Atoms are in Stable Contact and Free from Subsequent Grinding."

June 6, 1895. "Atomic Networks Identified: By their Equal Ratios of Atomic Size and Weight, Real Density and Specific Gravity, Planes of Least Contact and of Cleavage."

June 6, 1895. "The Separate Interlocking Atom Networks: Constructed from an Essential Four Row Girder, and Joints of Four to Twelve Equal Girders."

THE NEW COSMOLOGY.

COSMOLOGY treats of the most general laws of the material universe; in other words, of the most general laws of matter.

The laws of matter may be deduced, in the order of their generality, from a fundamental, all-inclusive definition of matter. And as such a method of deductive investigation is based entirely upon pure reason, it is therefore independent of the knowledge derivable through the organs of sense.

The fundamental definition of matter is arrived at by the following deductive method:

1. Any given portion of space, at any given point of duration, is either entirely or partially occupied by "substance;" and if almost entirely unoccupied by substance, such portion of space would very quickly become more occupied, because "vacuity does not resist the motion of substance."

2. Pure substance contains no vacuity, and pure vacuity contains no substance.

3. Pure vacuity has no positive quality; pure substance has but one quality.

4. Since pure substance has but one quality, it must therefore be either perfectly rigid, perfectly brittle, or perfectly fluid. If it were perfectly fluid, there would be no definite forms or motion of separate parts: it would everywhere be homogeneous both in density and energy, and neither form nor motion would have definite existence. If it were either perfectly rigid or perfectly brittle, it would then be finally divisible into separate particles; otherwise, motion would have no existence. If perfectly rigid, the particles would not be subject to breakage (at their instants of collision), and their forms and sizes would therefore be absolutely unalterable; they would therefore have no definite relations of form or of size, and no finite portion of them would have such definite properties as are manifested by the chemical elements of "stellar matter." We therefore conclude that pure substance is neither

perfectly fluid nor perfectly rigid; it must therefore be "perfectly brittle."

5. THE FUNDAMENTAL DEFINITION OF MATTER.—Matter is finally divisible into perfectly brittle "fragments," which differ from each other only in form and size.

6. THEOREMS.—A fragment has no pores or enclosed vacuities, because breakage would have gradually and completely exposed such enclosed vacuity. In other words, all vacuity is exterior to substance; for otherwise the universe would have both interior vacuity and exterior vacuity; and, since the breakage of the particles of substance would continually increase the ratio of exterior to interior vacuity, the universe would "soon" have no interior vacuity—which is equivalent to saying that the universe "never" did have, and "never" will have, any interior vacuity.

By the same method of reasoning, we prove that the average volume of substance per unit volume of "infinite space" is a constant and finite quantity. For if we were to suppose that any very enormous portion of space contained either more or less substance (in proportion) than that contained by "all space," then, in time, such disproportion would be eliminated, because of the freedom of motion possessed by the particles of substance. Therefore, every very enormous portion of space will "always" contain neither more nor less substance (in proportion) than any other enormous portion of space, whatever be their distance apart; and if "any" very enormous portion of space has a finite density of substance, then "every" very enormous portion of space has also the same density of substance. [The density of the interstellar medium, and the relative quantity of stellar and nebulous matter in that portion of space which is within range of our largest telescopes, cannot be appreciably different in any conceived equal-sized portion of space at any distance whatever from our locality.]

7. We may also infer that there is no appreciable difference of any kind existing between that "portion of the universe which lies within the sphere of our telescopic observation," and "any other equal-sized portion of the universe however so far distant." Also, we may prove that the universe is absolutely constant (as a whole) through all past and all future duration; that which is being created is likewise being destroyed at the same constant rate. The particles of substance are diverse in form, size, and states of aggregation; but the quantity of substance, apportioned to the different kinds of matter, does not vary—either to the whole, or relatively to

the different kinds—notwithstanding that substance is being constantly transmuted by the breakage and attrition of its particles. The absolute quantity of substance in any "presently enormous portion of space" would only equal the quantity in an atom of some far distant period in past duration. And, *vice versa*, an atom of the present will, in process of time, be so greatly subdivided by breakage, that its substance now equals that of myriad stars of such distant period in the future.

8. By reason of the perfect brittleness of the fragments, no finite portion of them can simultaneously possess "absolute" equality of form or size. And, since all special laws of matter depend upon the form and sizes of its final particles and their states of aggregation, it follows that all such laws are only approximately correct.

9. There is but one perfect law, which may be regarded as the law most universal in space and duration, and from which all other laws are finally deducible. It may be called the "fundamental law of matter."

10. THE FUNDAMENTAL LAW OF MATTER.—At the instant and through the point of the collision of two fragments an instantaneous fracture is created; the fracture being of least area and such form, as are requisite, in order that the "resultant force, total energy, and total substance" of the two colliding fragments may be incorporated, without change, by the four fragments into which they are thus broken.

11. THEOREMS.—Fragments are of all sizes; from that of the atoms (in stellar matter) down to absolute zero (in the finest particles of the universal ether or interstellar medium).

12. Infinitesimal fragments are infinitely more numerous (than those of finite size), and have all velocities, from zero to infinity (those of finite size having finite velocities). For analytical purposes we may consider that all fragments, of less than some certain size, constitute a "standard" medium, having constant properties.

13. PROPERTIES OF THE STANDARD MEDIUM.—The medium very slightly impedes the motion of a large fragment, very slowly wears away its projecting angles, and very powerfully presses from all directions upon its surface.

14. When the resultant pressure of the medium (immediately surrounding a fragment) is toward a particular direction, the fragment is then attracted toward that direction.

15. The medium radiates (with great velocity and slow absorp-

tion of energy and type) the local disturbances of its normal condition produced by an accumulation of fragments.

16. When the local disturbance is of constant type and intensity, then, at every moderate distance, its effect upon the medium will be of similar type, and the intensity inversely proportional to the square root of the distance.

17. [For convenience, let the small, rapidly moving fragments, constituting the all-pervading medium, be termed "particles" only, to distinguish them from the large, slowly moving fragments, which are subject to permanent accumulation by the general forces of attraction.]

18. [Particles may be distinguished analytically by a geometrical series of sizes; each size being infinitesimally smaller than the one preceding. The particles of each size would then constitute a separate medium, having infinitesimal density, pressure, etc. And the several quantitative functions of a particle (such as its relative number per unit volume of space, velocity of progression, rate of rotation, mean free path, etc.) would then form several different geometrical series—analogueous to and dependent upon the primary series of sizes.]

19. THE GENERAL TYPES OF ATTRACTION.—When the resultant pressure of the medium, immediately surrounding a fragment, is toward a particular direction, the fragment is then attracted toward that direction (see paragraph 14).

20. The pressure of the medium results from the "progressive" motion of its particles, and is not increased appreciably by their "rotary" motion.

21. A large fragment slightly decreases the progressive energy of the rapidly moving small particles striking it, and likewise slightly increases their rotary energy; it therefore tends to continually lessen the pressure of the immediately surrounding medium. And as the medium radiates the local effect upon its normal pressure, there is produced a permanent decrease of its pressure by an amount inversely proportional to the square root of the distance from the fragment producing the effect (see paragraphs 15 and 16).

22. Each fragment will therefore make a resultant pressure (in the medium) directed toward itself, by a force inversely proportional to the square root of the distance from itself.

23. [We have thus identified the force and law of gravity, which is the most perfect type of attraction. And we know that only large accumulations of fragments exert any considerable force

of the attraction of gravity; and single fragments, or small accumulations thereof, would therefore not affect each other's motions to any considerable extent.]

24. When two slowly moving large fragments chance to come sufficiently close to each other, each will ward off from the other some of the "direct" impacts which it would otherwise be receiving (from the small particles of the surrounding medium) upon that side which is toward the other; and they will thereby be drawn and held together permanently, unless subsequently so forcibly struck, by some rapidly moving fragment, as to be knocked far apart and thus permanently separated.

25. The foregoing type of attraction increases in force at a much greater rate than the inverse square root of the distance separating the two fragments. The force of attraction between the two fragments is very great when they are in contact, and is but infinitesimal when they are separated by a greater distance than the length of the longest "free paths" of the particles of the surrounding medium—because the two fragments do not then serve to ward off from each other any of the impacts of the particles.

26. [We have thus identified the force of cohesion, which causes the slowly moving large fragments to be powerfully attracted by each other when chancing to come sufficiently near each other.]

27. THE ACCUMULATION OF FRAGMENTS.—The force of cohesion causes the slowly moving large fragments to be drawn and held together permanently; and their accumulation, thus started in vast interstellar regions, is greatly accelerated by the far-reaching force of gravity; and the vast interstellar nebulae thus produced are further condensed, by the same forces of attraction, until they become star clusters and thence stars of the greatest size.

28. THE SEPARATION OF FRAGMENTS.—As the stars of a cluster keep combining to form larger stars—their distances apart and the velocities of their collisions continue to increase (owing to the increasing accumulations of gravity)—a limit of stellar size is thus reached, which causes the violence of the collision of two such enormous "final" stars to be sufficient to disfigure, rapidly break up, and widely scatter their constituent fragments. And owing to the very great initial velocity then given to them, they so widely disperse as to pass permanently away from each other's attraction.

29. When two "final" stars thus collide, there is produced a vast ring-like nebula of chaotic matter, expanding laterally with great initial velocity; and the greatest nebulae are thus produced. From

the form and magnitude of the Milky Way, we may conjecture that it was thus originated.

30. THE GRINDING OF FRAGMENTS TO SPHERICITY.—During the first stage of their accumulation, the fragments are as yet of very angular shape. But when two considerable accumulations of such fragments chance to forcibly collide, and the shock of their collision is distributed to the loosely arranged fragments, such fragments do then grind away each other's projecting angles, and thus acquire an approximately spherical shape.

31. EVOLUTION OF EQUAL-SIZED ATOMS.—Whenever a few of such approximately spherical fragments (if of nearly equal size) chance to come together, they will quickly arrange themselves in a compact stable arrangement (exactly identical to that which a quantity of equal-sized shot finally attain when shaken together in a vessel), and henceforth they are not so liable to be separated by the subsequent collisions of the accumulation. Such a nucleus of "primitive atoms" will subsequently shift about as a whole, and continually be increased in the number and perfection of its atoms. [The evolution of atoms depends upon the following law: AS THE SHOCK OF THE COLLISION OF TWO ACCUMULATIONS WILL BE PRINCIPALLY DISTRIBUTED TO THOSE PORTIONS WHERE THE FRAGMENTS ARE THE MOST UNSPHERICAL IN SHAPE, UNEQUAL IN SIZE, AND THEREFORE MOST LOOSELY ARRANGED: THEREFORE, THE GRINDING PROCESS WILL BE EFFECTIVE PRINCIPALLY IN SUCH UNSTABLE PORTIONS; AND "THE STABLE PORTIONS WILL GRADUALLY PREDOMINATE."] The most stable atomic arrangements will thus continually tend to predominate, and only those arrangements having perfect stability can continue to exist in the nebula as it advances in condensation.

32. EXACT RATIOS OF ATOMIC SIZE.—To understand the origin of "exact ratios of atomic size," we need only consider those special cases of exact juxtaposition or stable arrangements, admitting a few atoms of one size (forming a nucleus having octahedral or tetrahedral symmetry) to exactly replace a similar-shaped nucleus of atoms of another size; in other words, a few atoms of one size (forming a symmetrically shaped nucleus) might exactly be locked in place by surrounding atoms of another size.

33. THE GRADUAL PREDOMINATING OF CERTAIN ELEMENTS.—To properly understand the cause of the gradual predominating of a few atomic elements in the nebula, as it advances in condensation to become a star cluster, we must observe that the continued com-

binning of the accumulations gives great similarity to the subsequent stars of the star cluster. And we must also observe, that, at a certain stage of the process of condensation, certain elements are relatively so abundant as to form netlike structures through the mass of every star of the cluster. We must also observe that such netlike structures would have a common symmetrical formation; and in order that two such networks might exactly interlock, their respective atoms must needs have an exact ratio of size.

34. THE TYPICAL FORM OF AN ATOMIC NETWORK.—An atomic network of equal-sized atoms is formed by the symmetrical joining together of equal girders, or chains, of atoms; the essential form of a chain of atoms being that of four equal straight rows of atoms in compact juxtaposition. Such a chain of atoms would remain perfectly straight (because of the atoms remaining in contact by their attraction of cohesion). And the atoms of an element will therefore continually become more perfectly spherical, smooth, and equal in size, since they will thereby lend more perfect stability to the cohesion network which they form. A COMPLETE JOINT of such chains would necessarily have but one form, which would consist of twelve chains ending or joined, in exact symmetrical juxtaposition, at a common point. The exact form of a COMPLETE ATOMIC NETWORK is therefore perfectly determinate. The only variable feature of such a network is the "number of atom diameters" in a unit chain of the network.

35. [When two or more elements combine (by forming separate networks exactly interlocking with each other), such separate networks will not of necessity be "complete;" neither will they of necessity be similar modifications of the "complete" network; neither will they of necessity have the same number of atom diameters in their respective unit chains. The only essential feature of combination is that of "integral proportion," due to the simple molecules which are first formed, as the elements commence to combine while still in the incandescent state; the subsequent proportion being very approximately equal to that of the unit molecule of the incandescent gas.]

36. PLANETARY EVOLUTION.—We will suppose that an interstellar nebula has so far advanced in condensation as to be con-

sidered a star cluster—such as the Milky Way. The individual stars of the cluster are continually becoming fewer, and their average distance apart is continually becoming greater, because they are continually colliding and combining to form larger stars.

37. When two stars forcibly collide, they are quickly raised to such a great heat as to convert them into a single mass of intensely heated gas—in which their atoms are separately flying about with great velocity—and the two stars soon become perfectly mixed.

38. As the mass of gas cools (by its outward radiation of energy, as light or radiant heat), it contracts in volume, increases in its rate of rotation, and thence assumes the spheroidal shape.

39. A point is thence reached, at which the principal elements combine, and there is thus produced, in the rotating mass of gas, a succession of “exceedingly violent” contractions of its volume. And since the combination commences at the centre of such rotating spheroidal mass of gas, it would therefore reach the surface, first at the poles, and last at the equator. But because of the exceeding violence of the successive contractions (produced by the successive combinations), the greater part of the mass becomes successively detached from successive rings of matter at its extreme equator.

40. Such detached rings of molten lava, being suddenly freed from the centripetal force of “cohesion” (which previously, in addition to the attraction of gravity, helped to hold them to the central body), thence rapidly expand in a lateral direction, and thence reach those respective distances (from the central body) required by their respective rates of revolution.

41. As such a ring of molten lava (in laterally expanding to its proper distance from the central body) will cohere as a liquid, it will therefore become very thin and will soon separate, at some point. Its ring-like form will then rapidly disappear, because the liquid coherence of the lava will cause the broken ring to collect toward that point of its body which is equidistant from its two extremities.

42. A point is thence reached when the ring of lava has become a rotating spheroidal mass, and also revolving about the central body from which it became detached; thus it becomes a “planet.” But, owing to the great velocity with which the mass collects (both by cohesion and also, subsequently, by the accumulation of gravity), the liquid lava is rapidly raised in temperature; and if sufficiently intense to again separate any of the elementary combinations, the planet will, in cooling, evolve satellites. In stars of sufficient mass,

there might be planetary evolution to the third and fourth degree.

43. We may conjecture that the elements have about the same proportionate abundance in the planets as they have in the central body from which they became detached.

44. Notwithstanding that the planets have similar elementary composition, yet they will differ in their respective densities, owing to the respectively different conditions of their cooling, and the forming of such solid crusts as will stop their further volumetric contraction.

45. Active volcanoes upon a planet are conclusive evidence of its having a vast interior mass of molten lava, contained by a comparatively thin solid crust. And the attraction of a satellite, perpendicular to the planet's equator, would not cause the crust of the planet to bend thereto, however “flexible” such crust might be; because, by so bending, the form of the crust would be made somewhat less spherical, and therefore of somewhat less volumetric content, and, owing to the exceeding incompressibility of the enclosed liquid lava, its volume could not be perceptibly lessened by the feeble attraction of the satellite. [Therefore, the erroneous objection, commonly given against the theory of the interior fluidity of the earth—as it is based upon the rigidity of form held by the earth's surface, notwithstanding the moon's attraction—is easily refuted by the foregoing statement.]

46. THE PHENOMENA OF LIGHT.—Let us suppose two of the atoms of a gas to come within the reach of each other's cohesive attraction. Then, as the two atoms come together with rapidly increasing velocity, the medium becomes condensed at their point of collision, and a circular ring of condensation rapidly expands in the lateral direction. The small particles of the medium, intervening between the two atoms, keep them from coming into actual contact, and also act as an almost perfectly elastic cushion—whereby the two atoms are again forced apart with almost the velocity of their coming together. There is thus produced a periodic succession of collisions, and a corresponding series of equidistant concentric circular rings of condensation—such rings as will rapidly expand in a lateral direction, and constitute the phenomena of “light,” or radiant heat.

47. **ELEMENTARY SPECTRA.**—As the distances between the successive rings will be exactly proportional to the intervals elapsing between the successive collisions of the two atoms; and as such intervals will depend primarily upon the actual sizes of the two atoms (to which sizes their actual forces of cohesive attraction are due); and as in a gas of considerable rarity the two atoms would not be considerably interfered with (by the cohesive attraction of other atoms) while periodically colliding—therefore, in such a gas, each molecule will have its own proper set of periodic atomic concussions, and will also, therefore, give its own proper spectrum.

48. **PRACTICAL DEDUCTIONS.**—It is of practical importance to determine the special atomic arrangements formed by the atoms in solidifying or crystallizing; for the special properties of different substances depend entirely upon the sizes and relative numbers of their different atoms, and the resulting arrangements which they necessarily form in such substances.

49. The atomic composition of crystals, their specific gravities, their angles of cleavage, and their exterior forms furnish data for proving their theoretically determined atomic structures.

50. The writer has thereby succeeded in determining the principal types of atomic structure possessed by the elements in their principal combinations; and he has also calculated the corresponding "exact ratios" of atomic size required by such atomic structures (or exactly interlocking atomic networks formed by the elements in their most stable combinations); and he has also calculated the exact ratios of atomic size required by those atomic arrangements wherein simple molecules (of the large atoms of certain rare elements) are exactly held or locked in place by the symmetrical spaces in the atomic networks of the abundant elements.

51. We thus have a method for determining the "probability" of the existence of a rare element of any given atomic size, and also the "possibility" of any two given elements forming a stable combination; for, only those rare elements can have probable existence whose atoms may be exactly locked in by the atomic networks of the abundant elements, and only those elements can form stable combinations when the sizes of their atoms enable them to form exactly interlocking atomic networks. If the atoms of a

rare element are not capable of being exactly locked in place by the atoms of the abundant elements, such rare atoms will then be subject to continual wandering about through the molten lava of a star; and by thus wandering they will be more rapidly worn down in size—until they are reduced to such size as will enable them to be exactly locked in place—and thenceforth (until the star is again gasified by colliding with another star) such rare atoms will retain a constant size (relative to that of the abundant elements by which they are exactly locked in place). The epoch of the collision of two stars, and their subsequent gasification, liquefaction, and solidification, is therefore an epoch of partial modification for their atomic composition—such modification tending to reduce the number of their atomic elements, and thereby increase the individual abundance of such elements.

52. The writer has ascertained that crystalline osmium has an atomic arrangement exactly identical to that which is finally acquired by a quantity of equal-sized shot—when properly shaken together until they form successive straight rows and layers, exactly parallel and in contact. And by computing the real density of certain theoretical atomic networks, and multiplying such densities by the specific gravity of crystalline osmium (allowing for its inter-atomic spaces), he has obtained the corresponding theoretical specific gravities of such theoretical atomic networks.

53. He has thus ascertained that, in quartz, the number of atom diameters in a unit chain of the oxygen network equals fifteen, and that of the silicon network, sixteen; in alumina, that for oxygen equals sixteen, and that for aluminium, fifteen; in diamond, that for carbon equals fifteen, the carbon forming two interlocking networks. The foregoing data are given for illustration.

54. A few of the exact ratios of atomic size (required for octahedral and tetrahedral molecules of the rare elements held in place by the atoms of abundant elements) are as follows:

For octahedral molecules of six large atoms: 3.53107 and 1.99249. For tetrahedral molecules of four large atoms: 3.4560 and 1.8055. For an isolated atom (exactly held in place by surrounding smaller atoms), we have the size ratios, 10.1096, 3.0454, 9.0276, 2.4343, and 14.9615. The great extent to which the elements have

been primarily determined by the foregoing ratios (resulting from special atomic symmetrical arrangements) will appear evident from their extensive occurrence in the list of atomic weights. Thus, for the ratio 1.99249, we have the following instances: Li 7.01, N 14.01, Si 28.34, Fe 55.9, Cd 111.8; O 15.96, S 31.98; Ca 39.9, Br 79.75.

55. As the chemical application of the theory cannot be properly illustrated except by geometrical figures, and as the writer has not been financially enabled to have his charts lithographed, he therefore must defer some of the statements, of practical application to chemistry, until he obtains such assistance.

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